OPERATION AND MAINTENANCE INSTRUCTIONS

with

PARTS LIST

for

WESTON MODEL 622
PORTABLE DC MILLIAMMETER

Part Number 260249

Catalog Number 622-4963004

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WESTON INSTRUMENTS DIVISION
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GENERAL

This manual contains operating, maintenance, testing and calibration instructions with replacement parts list for the Weston Model 622 multirange dc milliammeter, part number 260249, manufactured by Weston Instruments, Inc., Newark, New Jersey.

The Model 622 is a highly sensitive portable instrument which measures 8-3/4 inches by 7-3/4 inches by 4 inches high (excluding leather carrying handle). The instrument is provided with a hinged cover which provides for complete instrument encasement and is electrostatically and magnetically shielded.

The instrument is provided with two current connecting binding posts, a range changing switch and a short circuiting key that operates automatically by closing the cover.

SPECIFICATIONS

Range(Milliamperes DC) . . 0 to 0.5/5/50/500
Scale(Milliamperes DC) . . 0 to 500 (100 Divisions)
Accuracy . . . . . ±0.5% of full scale deflection (with instrument in horizontal position)
Mechanism Sensitivity . . . 100 microamperes full scale deflection (shielded)
Internal Resistance . . . . . See Table I
Accessories . . . . . Leather carrying case and test leads available at nominal cost.

TABLE I. RESISTANCE VALUES

RANGE (MA)	RESISTANCE (Ω) ±0.1%		INSTRUMENT TERMINAL RESISTANCE (Ω) ±0.1%
	RESISTOR	SERIES SHUNT RESISTANCE	
500	R6 = 0.100	Section A R6 = 0.100	0.100
50	R5 = 0.900	Section B R6 + R5 = 1.000	0.999
5	R4 = 9.000	Section C R6 + R5 + R4 = 10.000	9.800
0.5	R3 = 90.000	Section D R6 + R5 + R4 + R3 = 100.000	80.000
NOTE - With a precision Wheatstone Bridge, adjust Mechanism Assembly (A1), spool resistor (R1), and Thermal Resistor (R2) series circuit to 400 ohms, ±0.1% total resistance.			

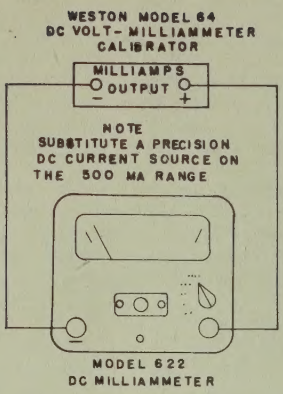
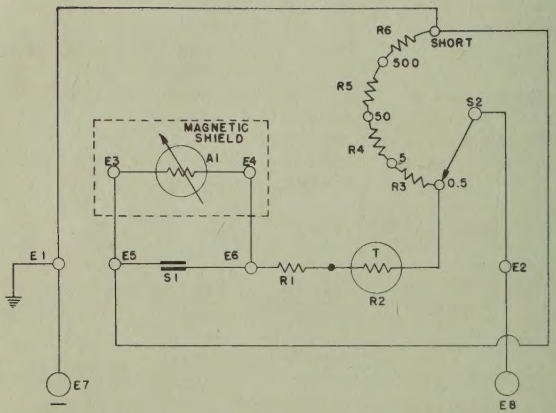


Figure 1. Calibration Circuit



A1 - Mechanism Assembly (82.2Ω)
E1, E2 - Base Terminal Lugs
E3 - Mechanism Top Bridge Terminal Lug
E4 - Mechanism Bottom Bridge Terminal Lug
E5, E6 - Base Terminal Lugs
E7 - Negative Binding Post
E8 - Positive Binding Post
R1 - Series Spool Resistor (320 Ω unadjusted)
R2 - Series Thermal Resistor (80 Ω @25°C)
R3 - Low Range Shunt Spool Resistor (100 Ω unadjusted)
R4 - Medium Low Range Shunt Spool Resistor (10Ω unadjusted)
R5 - Medium High Range Shunt Resistance Coil (0.9 Ω unadjusted)
R6 - High Range Shunt Resistance Coil (0.1Ω unadjusted)
S1 - Mechanism Short Circuit Contacts
S2 - Range Changing Switch

Figure 2. DC Milliammeter Schematic Diagram

OPERATING INSTRUCTIONS

This instrument is to be treated with the same care and respect given all standard pieces of laboratory equipment. It is calibrated for use only in the horizontal position and will provide accurate readings to within 0.5% of full scale deflection when used in that position.

Before using the instrument check the pointer indication to assure that it is exactly on the zero mark. If it is not, adjust to zero by turning the zero adjuster screw located on the case front just below the window.

MAINTENANCE INSTRUCTIONS

No periodic cleaning or lubrication is required of this instrument. The calibration check may be performed semi-annually to ascertain the continued accuracy.

CALIBRATION CHECK

Conduct the following procedure in ambient room temperature of 25°C (77°F) with the instrument in the horizontal position.

a. Connect the instrument in the circuit as illustrated in Figure 1.

b. Apply current and check each cardinal point on all ranges.

c. Each indication must be accurate to within 0.5% of full scale deflection. If the indications are not within the accuracy limits, refer to the trouble shooting chart and test procedures to determine the probable cause of calibration error.

TROUBLE SHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
FRICTION	Damaged pivots or jewel screws.	Replace pivots or jewel screws.
	Foreign particle in air gap.	Remove particle.
	Fuzz on moving coil.	Remove fuzz.
	Moving coil touching core.	Readjust jewel screws for proper moving coil clearance. Replace moving coil if it is bent or distorted.
	Distorted spring.	Realign spring with fine tweezers or replace it entirely.
	Jewel screws too tight.	Readjust jewel screws.
NO INDICATION	Open moving coil.	Replace moving coil.
	Poor solder connection.	Resolder connection.
VARIABLE READING	Poor connections.	Tighten or resolder connections.
	Friction.	See FRICTION section above.
	Loose balance weight.	Replace balance weight and rebalance.
	Distorted spring in moving element.	Realign spring with fine tweezers or replace it entirely.
INDICATES LOW	Friction.	See FRICTION above.
	Loose connections.	Tighten or resolder connections.
	Spring test too high.	Replace springs.
	Shorted turns on moving coil or incorrect moving coil.	Replace moving coil.
	Faulty or incorrect resistance.	Replace resistor.
	Insufficient magnet strength.	Recharge and treat magnet.
INDICATES HIGH	Spring test too low.	Replace springs.
	Incorrect moving coil.	Replace moving coil.
	Excessive magnet strength.	Treat magnet.
	Defective resistor.	Replace resistor.
INSUFFICIENT ZERO CORRECTION	Bridge abutment not adjusted properly.	Adjust bridge abutment.
CALIBRATION ERROR IN EXCESS	Moving element poorly balanced.	Rebalance moving element.
	Distorted spring.	Realign spring with fine tweezers or replace it entirely.

TEST PROCEDURES

The following tests are listed to assist in determining the probable cause for calibration error. Conduct the tests at ambient room temperature 25°C (77°F).

Balance Test

a. Place the instrument in a horizontal position on a test bench and adjust the pointer to the zero mark.

b. Lift the instrument to the vertical position and tilt it 50 degrees to the left and right. If the position of the pointer varies by more than 2% of the scale length from the initial reading in either of the positions mentioned it will be necessary to rebalance the moving element assembly.

Zero Correction Test

Turn the zero adjuster screw completely around in both directions. The pointer must deflect evenly and approximately 3% of the scale length to each side of the zero mark.

Dielectric Test

Gradually apply a potential of 3000 volts AC at 60 cycles for a period of one minute between the shorted binding posts and all exposed metal parts. If breakdown occurs, look for loose metal particles which may lodge in various sections of the instrument.

ADJUSTMENT PROCEDURES

The following procedures are recommended methods of performing the corrective action outlined in the trouble shooting chart.

Final Jewel Adjustment

This adjustment is made under open circuit conditions with the instrument horizontal. The magnet should be completely demagnetized when adjusting jewel screws.

a. Blow lightly on the pointer and permit it to oscillate freely. If the pointer does not oscillate freely turn the top jewel counterclockwise until free oscillation is obtained. While the pointer is oscillating slowly turn the top jewel screw clockwise until a slight damping is detected. Back off from this point approximately one-eighth turn.

b. Apply Butyl Methacrylate cement, Weston SND 23317-001 or equivalent per MIL-C-4003, to both top and bottom jewel screws.

Balancing the Moving Element Assembly

Before attempting to balance the moving element assembly be sure that the pointer is straight, in line with the moving coil, and swings parallel to the scale plate.

a. Hold the mechanism assembly with the pivot axis in a vertical plane and the pointer horizontal. Note the position of the pointer with a reference point as close to the pointer tip as possible.

b. Rotate the mechanism so that the pivot axis is horizontal and the pointer is parallel to the floor. Adjust the tailweight until the pointer is at its original reference position.

c. Rotate the mechanism so that the pivot axis is horizontal and the pointer is vertical. Adjust the side arm weights until the pointer is at its original reference position.

d. Repeat steps b and c as necessary. Refer to the Balance Test for checking procedure.

Magnet Charging

Charge the magnet on a suitable magnet charger. Select an electromagnet type charger with a capacity of approximately 30,000 ampere turns. The direction of magnetic charge shall be such that when assembled in the mechanism the pointer deflects in a clockwise direction when viewed from the top of the mechanism with the pointer tip away from the observer and negative polarity applied to the mechanism top bridge terminal.

ADJUSTMENT AND CALIBRATION PROCEDURES

The replacement scale plate for this instrument is supplied semi-printed. That is, the only marks of calibration are the zero and end scale points. All other graduations are inscribed during calibration procedure. When recalibrating it may be possible to use the original calibrated scale, but in most cases it will be necessary to calibrate a new scale. The following procedure is recommended to calibrate the new scale. Conduct the procedure in ambient room temperature of 25°C (77°F).

a. Mount the semi-printed scale and the magnetically charged mechanism in the instrument case.

b. By means of the moving element series resistor spool (R1) adjust the series resistance of the moving element and resistor combination to the resistance noted in Table I.

c. Apply the mechanism sensitivity current to the mechanism. If the pointer does not deflect beyond end scale mark, the spring test is too high, the moving coil has an insufficient number of turns, or the magnet is not fully charged.

d. By use of an energized demagnetizing coil, slowly pull down the magnet strength until the pointer indicates end scale mark.

e. Minor adjustment to end scale may be accomplished by adjusting the mechanism magnetic shunt.

f. By use of the resistor spool, adjust Section A resistance to the value shown in Table I. (See Table I and Figure 2.)

g. Adjust the resistance of Section B to that value shown in Table I. As indicated in Figure 2, all shunt resistors are connected in series.

h. Adjust the resistance for the remaining sections in a similar manner, always adjusting the unadjusted resistor so that the total resistance of the section is within the resistance value specified in Table I.

i. Wire all resistors in the circuit as illustrated in Figure 2.

j. Connect the ammeter in the circuit as illustrated in Figure 1, with the instrument switch on the high range.

k. Vary the applied current and mark the scale accordingly. Check all calibration points on each range and repeat above procedure as needed to correct for any calibration error.

REPLACEMENT PARTS LIST
OF PECULIAR PARTS
MODEL 622 MULTIRANGE MILLIAMMETER
0 to 0.5/5/50/500 MILLIAMPERES DC

In order to formulate the complete parts list for this range milliammeter, insert the following line information into the common parts listing. Upon transposition, the common parts listing will become a complete and specific replacement parts list.

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
1	260249	MILLIAMMETER, DC, Multirange, with range changing switch and two binding posts, Model 622, range 0 to 0.5/5/50/500 milliamperes	-
5	F1602	Certificate	1
42	250168-901	Dial, Scale, semi-printed	1
59	190393-901	Resistor, WW, 320 ohms unadjusted, R1	1
60	ND20777-001	Resistor, WW, 80 ohms @ 25°C, R2	1
61	46912-901	Resistor, WW, 100 ohms unadjusted, R3	1
62	44726-901	Resistor, WW, 10 ohms unadjusted, R4	1
63	No Number	Resistor, Wire Coil, 12.6 mil dia Manganin Wire, 7 in. lg, 0.9 ohms unadjusted, R5	1
64	No Number	Resistor, Wire Coil, 25.3 mil dia Manganin Wire, 3 in. lg, 0.1 ohms unadjusted, R6	1
92	130152-901	Magnet	1
116	247835-912	Moving Element Assy	1
118	112806-901	Springs Paired (13A Total Test)	1 Pr.
124	77126-901	Coil, Meter Movement (Part of Element Assy)	1
139	77953-901	Pole Piece Assy	1
139A	246284-901	Plate, Identification (Decal)	1

COMMON PARTS LISTING

(to be used with Peculiar Parts List)

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
1	*	AMMETER, DC, Multirange, with range changing switch and two binding posts, Model 622 (See specific parts list for range)	-
2	ND33336-024	Screw, Machine (Mtg Bezel)	4
3	41177-237	Bezel	1
4	41493-001	Plastic Sheet	1
5	*	Certificate	1
6	75400-001	Foot, Rubber	7
7	75398-024	Washer, Flat	7
8	198828-901	Cover	1
9	ND33623-024	Screw, Machine (Mtg hinge)	12
10	32737-048	Hinge, Short pin	1
11	29059-048	Hinge, Long pin	1
12	ND33172-024	Screw, Machine (Mtg catch)	6
13	ND13327-024	Catch, Spring	1
14	117125-024	Screw, Machine	8
15	27083-024	Washer, Lock	8
16	74901-024	Stud	2
17	74900-024	Nut, Plain, hex	2
18	16624-001	Handle, Leather	1
19	ND37381-001	Knob, Switch	1
20	ND15750-024	Nut, Plain, hex	4
21	198427-901	Lead Assy	2
22	ND11571-024	Washer, Lock	2
23	ND33700-024	Washer, Flat	2
24	ND37382-001	Post, Binding	2
25	14765-001	Screw, Instrument	1
26	53550-001	Crank, Zero corrector	1
27	17647-001	Washer, Spring	1
28	42922-024	Washer, Flat	1
29	77108-050	Stud, Zero corrector	1
30	ND19692-007	Screw, Drive	2
31	198824-901	Plate, Identification	1

* See Peculiar Parts List for Part No. and other details.

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
32	74060-024	Bushing, Shorting key	1
33	74085-001	Spring, Shorting key	1
34	198444-901	Stud Assy, Shorting key	1
35	69882-001	Gasket, Shorting key	1
36	188226-001	Clip, Window	6
37	74010-001	Window, Meter	1
38	247509-905	Case, Drilled (Not engraved)	1
39	87794-024	Screw, Machine (Mtg dial)	4
40	27083-024	Washer, Lock (Mtg dial)	4
41	81139-024	Terminal, Grounding	1
42	*	Dial, Scale, semi-printed	1
43	198432-024	Stud (Dial mtg)	2
44	ND33421-024	Screw, Machine (Mtg shield)	2
45	27083-024	Washer, Lock (Mtg shield)	2
46	74021-045	Cover, Shield, lower	1
47	198430-045	Cover, Shield, upper	1
48	ND33421-024	Screw, Machine (Mtg resistor deck)	2
49	27083-024	Washer, Lock (Mtg resistor deck)	2
50	331-024	Nut, Plain, hex (Resistor spool mtg)	AR
51	27083-024	Washer, Lock (Resistor spool mtg)	AR
52	16657-024	Washer, Flat (Resistor spool mtg)	AR
53	61721-024	Washer, Flat (Resistor spool mtg)	AR
54	16000-024	Pin, Screw (Resistor spool mtg)	AR
55	ND21430-024	Screw, Machine (Resistor spool mtg)	AR
56	ND21181-024	Screw, Machine (Resistor spool mtg)	AR
57	ND19795-024	Screw, Machine (Resistor spool mtg)	AR
58	198426-001	Deck, Resistor spool	1
59	*	Resistor, R1	1
60	*	Resistor, R2	1
61	*	Resistor, R3	1
62	*	Resistor, R4	1
63	*	Resistor, R5	1
64	*	Resistor, R6	1

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
65	ND33331-024	Screw, Machine (Mtg Terminals and contacts)	4
66	27083-024	Washer, Lock (Mtg Terminals and contacts)	4
67	ND21068-033	Terminal (Internal connection)	2
68	113694-024	Terminal, Grounding	1
69	46830-033	Terminal, (E5, E6)	2
70	74061-024	Contact (Shorting key)	2
71	331-024	Nut, Plain, Hex (Mtg switch plate)	3
72	27083-024	Washer, Lock (Mtg switch plate)	3
73	198821-001	Gasket	1
74	198446-024	Plate, Switch Mounting	1
75	198447-901	Switch, Range Selector	1
76	198445-024	Stud, Switch Mounting	3
77	74012-001	Gasket (Base to Case)	1
78	198425-050	Base	1
79	ND33238-024	Screw, Machine (Mech Assy to Shield)	4
80	ND37041-024	Washer, Lock (Mech Assy to Shield)	4
81	ND33331-024	Screw, Machine (Shield to Base)	4
82	27083-024	Washer, Lock (Shield to Base)	4
83	247511-901	Shield Assy	1
84	No Number	Mechanism Assy, A1 (Listed for ref only. Consists of the following parts)	1
85	ND33093-024	Screw, Machine (Plate to Magnet Shank)	4
86	ND37005-024	Washer, Lock (Plate to Magnet Shank)	4
87	130157-024	Clamp, Magnet	1
88	247513-024	Plate	1
89	130155-024	Screw, Machine (Magnet Shank to Pole Piece)	2
90	ND37047-045	Washer, Lock (Magnet Shank to Pole Piece)	2
91	130154-045	Shank, Magnet	2
92	*	Magnet	1

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
93	44427-024	Screw, Machine (Mtg top bridge)	2
94	8161-001	Washer, Nonmetallic (Top bridge)	2
95	78663-024	Cushion spring	2
96	ND29918-033	Terminal (E3)	1
97	247516-901	Bridge Assy, Top	1
98	14343-024	Screw, Instrument (Clamp Mtg) (Part of Bridge Assy)	1
99	14345-024	Clamp, Spring (Part of Bridge Assy)	1
100	54122-901	Jewel and Screw Assy (Part of Bridge Assy)	1
101	250657-001	Nut, Locking (Part of Bridge Assy)	1
102	59440-001	Washer, Spring (Part of Bridge Assy)	1
103	157060-024	Washer, Flat (Part of Bridge Assy)	1
104	247517-024	Abutment (Part of Bridge Assy)	1
105	250659-901	Bridge, Top (Part of Bridge Assy)	1
106	20955-001	Insulator, Bridge	2
107	8161-001	Washer, Nonmetallic (Mtg Bridge)	2
108	14062-024	Nut, Plain, hex (Mtg magnetic shunt)	1
109	ND37025-024	Washer, Lock	1
110	ND37875-024	Washer, Flat	1
111	60337-045	Shunt, Magnetic	1
112	74854-024	Nut, Special	1
113	60904-024	Screw, Machine (Spacer to Nut)	1
114	60338-024	Spacer	1
115	6919-024	Core	1
116	*	Moving Element Assy	1
117	22960-001	Nut (Part of Element Assy)	2
118	*	Springs, paired (Part of Element Assy)	1 Pr
119	74057-001	Pointer (Part of Element Assy)	1

ITEM NUMBER	PART NUMBER	DESCRIPTION	QTY PER ASSY
120	19342-001	Nut, Balance (Part of Element Assy)	AR
121	19343-001	Nut, Balance (Part of Element Assy)	AR
122	51631-001	Nut, Balance (Part of Element Assy)	AR
123	115888-001	Pivot (Part of Element Assy	2
124	*	Coil, Meter Movement (Part of Element Assy)	1
125	44427-024	Screw, Machine (Mtg Bottom Bridge)	2
126	8161-001	Washer, Nonmetallic (Bottom Bridge)	3
127	ND29918-033	Terminal Lug (E4)	1
128	247518-901	Bridge Assy, Bottom	1
129	14343-024	Screw, Special (Part of Bridge Assy)	1
130	14345-024	Clamp, Spring (Part of Bridge Assy)	1
131	67481-901	Jewel and Screw Assy (Part of Bridge Assy)	1
132	250657-001	Nut, Locking (Part of Bridge Assy)	1
133	59940-001	Washer, Spring (Part of Bridge Assy)	1
134	157060-024	Washer, Flat (Part of Bridge Assy)	1
135	247519-024	Abutment, Lower (Part of Bridge Assy)	1
136	250659-901	Bridge, Bottom (Part of Bridge Assy)	1
137	20955-001	Insulator, Bridge	2
138	8161-001	Washer, Nonmetallic	2
139	*	Pole Piece Assy	1

Select 3 as Req'd

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